

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

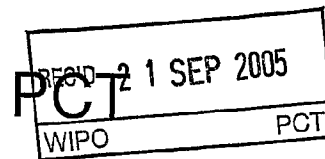
Applicant's or agent's file reference <b>05003 P PCT</b>	<b>FOR FURTHER ACTION</b>		See item 4 below
International application No. <b>PCT/EP2005/000320</b>	International filing date ( <i>day/month/year</i> ) <b>14 January 2005 (14.01.2005)</b>	Priority date ( <i>day/month/year</i> ) <b>16 January 2004 (16.01.2004)</b>	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237			
Applicant <b>CARL ZEISS SMT AG</b>			

<p>1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 <i>bis</i>.1(a).</p> <p>2. This REPORT consists of a total of 10 sheets, including this cover sheet.</p> <p>In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.</p>																
<p>3. This report contains indications relating to the following items:</p> <table> <tr> <td><input checked="" type="checkbox"/> Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. II</td> <td>Priority</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/> Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/> Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input checked="" type="checkbox"/> Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> <p>4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).</p>	<input checked="" type="checkbox"/> Box No. I	Basis of the report	<input checked="" type="checkbox"/> Box No. II	Priority	<input checked="" type="checkbox"/> Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input checked="" type="checkbox"/> Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/> Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/> Box No. VI	Certain documents cited	<input type="checkbox"/> Box No. VII	Certain defects in the international application	<input checked="" type="checkbox"/> Box No. VIII	Certain observations on the international application
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<input checked="" type="checkbox"/> Box No. VIII	Certain observations on the international application															

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No. +41 22 338 82 70</p>	<p>Date of issuance of this report <b>17 July 2006 (17.07.2006)</b></p>
	<p>Authorized officer</p> <p><b>Ellen Moyse</b></p> <p>c-mail: pt05@wipo.int</p>

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL SEARCHING AUTHORITY



To:

see form PCT/ISA/220

## WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing  
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference  
see form PCT/ISA/220

### FOR FURTHER ACTION

See paragraph 2 below

International application No.  
PCT/EP2005/000320

International filing date (day/month/year)  
14.01.2005

Priority date (day/month/year)  
16.01.2004

International Patent Classification (IPC) or both national classification and IPC  
G03F7/20, G02B27/28, G02B5/30

Applicant  
CARL ZEISS SMT AG

### 1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

### 2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

### 3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/EP2005/000320

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**Box No. I Basis of the opinion**

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1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
  - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material:
    - ☐ a sequence listing
    - ☐ table(s) related to the sequence listing
  - b. format of material:
    - ☐ in written format
    - ☐ in computer readable form
  - c. time of filing/furnishing:
    - ☐ contained in the international application as filed.
    - ☐ filed together with the international application in computer readable form.
    - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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**Box No. II Priority**

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1. ☒ The validity of the priority claim has not been considered because the International Searching Authority does not have in its possession a copy of the earlier application whose priority has been claimed or, where required, a translation of that earlier application. This opinion has nevertheless been established on the assumption that the relevant date (Rules 43*bis*.1 and 64.1) is the claimed priority date.
2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.
3. Additional observations, if necessary:

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/EP2005/000320

**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 56-81

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for the whole application or for said claims Nos. 56-81

☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form

☐ has not been furnished

☐ does not comply with the standard

the computer readable form

☐ has not been furnished

☐ does not comply with the standard

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

☐ See separate sheet for further details

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**

International application No.  
PCT/EP2005/000320

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**Box No. IV Lack of unity of invention**

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1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees, the applicant has:
- ☒ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☐ not paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
- ☐ complied with
  - ☒ not complied with for the following reasons:  
**see separate sheet**
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☐ all parts.
  - ☒ the parts relating to claims Nos. 1-55

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**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1-55
	No: Claims	
Inventive step (IS)	Yes: Claims	9-31,33-55
	No: Claims	1-8,32
Industrial applicability (IA)	Yes: Claims	1-55
	No: Claims	

2. Citations and explanations

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Re. Item III**

The question of novelty and inventive step has not been examined for claims 56-81 for the following reasons: no search report was established for these claims, hence no opinion could be formed (Art.15(3), Art.17(2) PCT and R.33(3)(a) PCT).

**Re. Item IV**

As already mentioned in the International Search Report (ISR), the present statement of claim appears to contain 7 groups:

First group: Claims 1-31

**Claim 1 relates to a polarization-modulating optical element comprising an optically active crystal having an optical axis (claims 2-31 are dependent thereupon).**

**The problem to be solved is how to rotate the oscillation plane of the electrical field vector of linearly polarized light by an angle proportional to the distance travelled in said crystal.**

**The special characteristic is the thickness profile being variable along said optical axis.**

Second group: Claims 32-55

**Claim 32 relates to a polarization-modulating optical element comprising an optically active crystal (claims 33-55 are dependent thereupon).**

**The problem to be solved is how to produce an arbitrarily selected distribution of the oscillation planes of the electrical field vector of linearly polarized light traversing said crystal.**

**The special characteristic is the two different angles at which two different linearly polarized light rays are rotated.**

Third group: Claim 56

**Claim 56 relates to a method for manufacturing a micro-structured semiconductor component.**

**The problem to be solved is how to increase the achievable resolution by enabling immersion micro-lithography technique.**

**The special method step is using a projection system where a polarization modulating optical element comprising an optically active crystal is arranged in its illumination system.**

Fourth group: Claims 57-64

**Claim 57 relates to an optical system having an optical axis and a polarization modulating element comprising an optically active material (claims 58-64 are dependent thereupon).**

**The problem to be solved is how to... produce a tangential polarization distribution.**

**The special characteristic is the effective thickness profile being variable in a direction non parallel to said optical axis.**

Fifth group: Claims 65-74

**Claim 65 relates to an optical system having an optical axis and a polarization modulating element (claims 66-74 are dependent thereupon).**

**The problem to be solved is how to thermally control the change of polarization.**

**The special characteristics are the:**

- effective thickness profile being constant along the optical axis of a solid and/or liquid optically active material therein;
- polarization control system having a heating or cooling device.

Sixth group: Claims 75-80

**Claim 75 relates to an optical system having an optical axis and two polarization modulating elements (claims 76-80 are dependent thereupon).**

**The problem to be solved is how to athermalise the system.**

**The special characteristics are the:**

- two polarization modulating elements having optically active materials with specific rotations of opposite signs; and
- effective thickness profile of one polarization modulating element being variable in a direction non parallel to the optical axis of a solid and/or liquid optically active material therein; and/or

- effective thickness profile of one polarization modulating element being constant in a direction non parallel to the optical axis of a solid and/or liquid optically active material therein.

Seventh group: Claim 81

**Claim 81 relates to a method for manufacturing micro-structured semiconductor components.**

**The problem to be solved is how to control the change of polarization by Faraday effect.**

**The special method step is using a projection system comprising a polarization modulating optical element having optically active or inactive material subjected to a magnetic field.**

**The application relates to a plurality of (7) groups of claims in the sense of R.13.1 PCT. They have been divided as defined above. If the applicant pays additional fees for one (or more) not yet searched group(s) of claims, then the further search(es) may reveal further prior art that gives evidence of a further lack of unity 'a posteriori' within one (or more) of the not yet searched group(s). In such a case only the first group of claims, which is considered to lack unity of invention, will be the subject of a search. No further invitation to pay further additional fees will be issued (this is because Art.17(3)(a) PCT stipulates that the ISA shall establish the International Search Report (ISR) on those parts of the international application which relate to the invention first mentioned in the claims ('main invention') and for those parts which relate to inventions in respect of which the additional fees were paid - Neither the PCT nor the PCT guidelines provide a legal basis for further invitations to pay further additional search fees (W17/00, point 11 and W1/97, points 11-16)).**

In the absence of response from the applicant, an International Preliminary Examination Report (IPER) will be established on those parts of the international application which appear to relate to the main invention, i.e. the first group (claims 1-31).

**Re. Item V**



The application does not meet the requirements of Art.33(1) PCT for the following reasons:

- 1 - The documents mentioned in the International Search Report (ISR) are labelled as D1-D3 in their order of appearance.
- 2 - Document D1 (GB 856 621 A) discloses a polarization-modulating optical element (see figure 4 (20)) which has a thickness profile and consists of, or comprises, an optically active material (see e.g. page 3 lines 11-15) with an optical axis, wherein said thickness profile measured along said optical axis is variable. A crystal is considered as a non-inventive choice of optically active material.  
Document D3 (US 3 438 692 A) discloses a polarization-modulating optical element wherein the plane of oscillation of a first linearly polarized light ray and the plane of oscillation of a second linearly polarized light ray are rotated by a first, respectively a second, angle of rotation in such a way that the first angle of rotation is different from the second angle of rotation, and wherein said polarization-modulating optical element consists of, or comprises, an optically active material (see half-wave plate disclosed column 5 lines 7-28 and figure 1). Furthermore, the subject-matter of claim 32 is anticipated by any half-wave plate/wedge made of e.g. quartz.  
Thus, the subject-matter of **claims 1 and 32** appears to lack an inventive step in the meaning of Art.33(3) PCT.
- An inventive step in the subject-matter of claims 2-8 does not appear to be present in view of document D2 (US 5 867 315 A) in combination to document D1 (Art.33(3) PCT).  
Thus, the subject-matter of **claims 2-8** appears to lack an inventive step in the meaning of Art.33(3) PCT.
- None of the documents cited in the International Search Report appear to disclose or suggest the additional structural features of dependent claims 9-31 and 33-55.  
Therefore, claims 9-31 and 33-55 appear to satisfy the requirements of Art.33(1) PCT with regard to the documents cited in the International Search Report.

**Re. Item VIII**

The application does not appear to meet the requirements of Art.6 PCT for the following reasons:

- In claim 1, the phrasing "*of the optical axis*" should be replaced by "of the optical axis of said optically active crystal".
- The phrasing of claim 32 ("*in such a way that*") attempts to define its subject-matter in terms of an effect and fails to specify by which structural feature(s) said effect is actually achieved. Also, it should be made clear that the second light ray differs from the first one.

The application does not meet the requirements of R.5.1.(a)(ii) PCT (citation of relevant prior art documents).

The application does not meet the requirements of R.6.3.(b)(I) and (ii) PCT (two-part form of the independent claims).

The application does not meet the requirements of R.6.2.(b) PCT (reference numerals in all the claims).

The attention of the applicant is further drawn to the fact that if the application contains an unjustified plurality of independent claims, no examination of any of the claims will be carried out.